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(54) Title: SOFT STRETCHABLE COMPOSITE FABRIC

(57) Abstract

A stretchable water vapor permeable composite material comprisinga layer of porous film adhesively laminated to a layer of fabric; said porous film and said fabric having lower tensile modulus in the transverse direction than in the machine direction and having their axes of lower tensile modulus in parallel alignement, and each having, at 25 % extension in the transverse direction, a force to displacement (F/D) ratio per inch width less than 3.5; and said composite material having, at 25 % extension in the trasverse direction, an F/D ratio per 2.54 cm width less than 9.0. This composite fabric has barrier properties such as windproofness and water-penetration resistance and is suitable for use in many types of lightweight or close-fitting garments.

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TITLE OF THE INVENTION

SOFT STRETCHABLE COMPOSITE FABRIC

FIELD OF THE INVENTION

This invention is related to stretchable layered composite fabrics, more particularly, to layered composite fabrics which provide barrier properties with water vapor permeability.

BACKGROUND OF THE INVENTION

Knitted fabrics are generally softer, more drapeable, offer less resistance to stretching and can be stretched without damage further than woven fabrics. These comfort related properties are very important considerations in the design and manufacture of many types of lightweight or close-fitting garments.

Lightweight knitted fabrics have a relatively open construction, exhibit high air permeability and, consequently, have virtually no barrier properties such as windproofness or thermal insulation qualities. This severely limits the outdoor applications in colder weather without additional outer layers.

It is very desirable to enhance the barrier properties of the lightweight knitted fabrics while continuing to provide comfort related properties such as softness, drapeability, stretchability, stretch-recovery and water-vapor-permeability.

SUMMARY OF THE INVENTION

This invention provides soft drapeable stretchable water-vapor-permeable layered composite materials having low tensile modulus in the transverse direction and having functional properties such as windproofness, water-vapor-permeability, weather resistance or waterproofness.

By "tensile modulus" it is meant the resistance of a material to be stretched or elongated. It is expressed herein in terms of

the force (F) required to stretch or elongate the material a specified distance (D).

By "windproofness" it is meant a low rate of permeability of air through the material. It is expressed herein in terms of the volume of air (cm^3) passing through a given area (cm^2) in a given time (min) under a given pressure drop (mm water pressure).

The force to displacement (F/D) ratio as used herein is the ratio obtained by dividing the tensile force (expressed in Newtons) to stretch a 2.54 cm wide specimen to 1.25 times its original length (25% extension) by the displacement (expressed in centimeters) to reach 25% extension.

Transverse direction is used herein to indicate the direction in the plane of manufacture perpendicular to the machine direction (direction of manufacture). The materials of the layers described herein are considered to be planar, defined by their length (machine direction) and width (transverse direction).

The composite material of the invention can comprise a layer of porous film adhesively laminated to a layer of fabric; the porous film and the fabric each having, at 25% extension in the transverse direction, an F/D ratio per 2.54 cm width less than 3.5; and the composite material having an F/D ratio less than 9.0.

Another embodiment of the composite material of the invention can comprise a layer of porous film to each side of which is adhesively laminated a layer of fabric; the porous film and the fabric each having, at 25% extension in the transverse direction, an F/D ratio less than 3.5; and the composite material having, at 25% extension in the transverse direction, an F/D ratio less than 9.0.

By "porous" is meant that the film has pores or voids from one side to the other.

To enhance barrier properties such as windproofness or waterproofness the porous film of the embodiments above may be coated with a continuous substantially air-impermeable layer of hydrophilic water vapor-permeable polymer, e.g. a polyurethane, which prevents passage of liquid water through it, but has high water-vapor-permeability.

The stretchable water-vapor-permeable layered composite material of the invention has excellent drape characteristics and

can be substantially stretched in the transverse direction by application of very low forces without loss of important functional characteristics such as windproofness, water-vapor-permeability, weather resistance or waterproofness.

To enhance these properties, the axes of lower tensile modulus of the layers of the composite are aligned in substantially parallel orientation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The layered composite materials of the invention are engineered to enhance softness, drape, stretchability and stretch-recovery, and to minimize resistance to stretching in the transverse direction, first through selection of component materials, each preferably having high softness, drape, stretchability and stretch-recovery, and each having lower tensile modulus in the transverse direction than in the machine direction; and secondly, in contrast to conventional practices, by aligning the axis of lowest tensile modulus of each layer in the same direction with respect to its neighboring layers. Thus, it can be seen that an important element in the construction of the layered composite material of the invention is the relative orientation of the tensile properties of each layer.

A preferred embodiment of the stretchable water-vapor-permeable composite material of the invention comprises a layer of porous film adhesively laminated to a layer of fabric. Another preferred embodiment of the invention comprises a layer of porous film to each side of which is adhesively laminated a layer of fabric.

The porous film may have a pore volume in the range 40 - 95 percent, preferably 60 - 95 percent; a mean pore size smaller than about 2 micrometers, preferably smaller than 1 micrometer; air permeability less than about 91 cubic centimeters/minute/square centimeter at a pressure drop of 12.7 millimeters water; lower tensile modulus in the transverse direction than in the machine direction, and an F/D ratio, at 25% extension in the transverse direction, less than 3.5. The porous film may be a membrane, mesh,

or nonwoven web selected from, but not limited to the group: polyolefin, polyamide, polyester, polyurethane, fluoropolymer, and the like. Such films are known in the art and are commercially available. The preferred film is porous polytetrafluoroethylene, more preferably, porous expanded polytetrafluoroethylene film having a porous structure of interconnected nodes and fibrils as described in USP 3,953,566 (Gore) and USP 4,187,390 (Gore), and is manufactured by W.L.Gore and Associates, Inc.

The porous film may be coated with a continuous substantially air-impermeable layer of hydrophilic water-vapor-permeable polymer. The coating increases the barrier properties of the porous film such as liquid water penetration resistance, windproofness, and heat transfer resistance while continuing the important comfort related properties of water vapor transmission through the film and low tensile modulus; the coated film having, at 25% extension in the transverse direction, an F/D ratio less than 3.5.

Hydrophilic water-vapor-permeable polymers are known in the art and are available commercially. Most preferred for the coated film of the composite material of the invention is a hydrophilic water-vapor-permeable polyurethane polymer of the type described in USP 4,194,041 (Gore,et al) or, alternatively, of the type described in USP 4,532,316 (Henn).

The fabric of the layered composite material of the invention has lower tensile modulus in the transverse direction than in the machine direction and an F/D ratio, at 25% extension in the transverse direction, less than 3.5. Knit fabric is preferred for its ability to stretch and recover from stretching. Most preferred is circular knit fabric. Circular knit fabric includes both single knit and double knit fabric of the type: Jersey, double jersey, jacquard double jersey, interlocks, narrow and broad rib, and the like. Furthermore, the fabric may be processed to provide greater loft as exemplified by fleece, pile, brushed, or velour fabrics, and the like. Such fabrics are well known to have high softness, drapeability, stretchability and stretch-recovery.

The fabric can be made from yarn of synthetic fibers or natural fibers, or blends of synthetic and natural fibers, depending on the intended application of the fabric. For example, for external wear and outer garment use fabric of polyamide,

polyester, polyacrylic, or other synthetic fibers may be preferred for their mechanical properties and environmental resistance. On the other hand, for inner wear or undergarment applications, where fabric hand, skin-feel, water wicking and heat transfer properties assume much greater importance, natural fibers such as cotton or wool may be preferred.

The adhesive to bond together the layers of the composite material of the invention may be selected from many known in the art. Suitable adhesives may be found in, but not limited to, the class consisting of thermoplastic polymers, thermosetting polymers, or reaction curing polymers. They may be applied to the surfaces to be laminated by conventional means, for example by coating or printing methods. Also, in embodiments incorporating the coated film described hereinabove, the hydrophilic polyurethane polymer of the coating may be used to adhesively bond the coated film layer to the fabric layer. The method and material selected for adhesively bonding the layers is based on end use requirements projected for the composite material.

TEST DESCRIPTIONS

WATER VAPOR TRANSMISSION RATE (WTVR)

A description of the test employed to measure water vapor transmission rate (WVTR) is given below. The procedure has been found to be suitable for testing films, coatings, and coated products.

In the procedure, approximately 70 ml. of a solution consisting of 35 parts by weight of potassium acetate and 15 parts by weight of distilled water was placed into a 133 ml. polypropylene cup, having an inside diameter of 6.5 cm. at its mouth. An expanded polytetrafluoroethylene (PTFE) membrane having a minimum WVTR of approximately 85,000 $g/m^2/24$ hrs. as tested by the method described in U.S. Patent 4,862,730 to Crosby and available from W. L. Gore & Associates, Inc. of Newark, Delaware, was heat sealed to the lip of the cup to create a taut, leakproof, microporous barrier containing the solution.

A similar expanded PTFE membrane was mounted to the surface of a water bath. The water bath assembly was controlled at 23°C plus 0.2°C, utilizing a temperature controlled room and a water circulating bath.

The sample to be tested was allowed to condition at a temperature of 23°C and a relative humidity of 50% prior to performing the test procedure. Samples were placed so the microporous polymeric membrane was in contact with the expanded polytetrafluoroethylene membrane mounted to the surface of the water bath and allowed to equilibrate for at least 15 minutes prior to the introduction of the cup assembly.

The cup assembly was weighed to the nearest 1/1000g. and was placed in an inverted manner onto the center of the test sample.

Water transport was provided by the driving force between the water in the water bath and the saturated salt solution providing water flux by diffusion in that direction. The sample was tested for 15 minutes and the cup assembly was then removed, weighed again within 1/1000g.

The WVTR of the sample was calculated from the weight gain of the cup assembly and was expressed in grams of water per square meter of sample surface area per 24 hours.

TENSILE TEST

The tensile properties of the materials were determined using a constant rate-of-jaw separation type machine (Instron testing machine, Model 1122).

Materials were cut into 2.54 centimeter wide strips in both machine and transverse directions. Samples were allowed to condition in a controlled room at a temperature of 21°C and 65% relative humidity.

The gauge length of the test was 5.08 centimeters and the strain rate was 500% / minute. All samples were tested to break.

The tensile modulus of the materials is reported as the force to displacement (F/D) ratio obtained by dividing the tensile force (expressed in Newtons) to stretch a test specimen to 1.25 times its

original length (25% extension) divided by the displacement (expressed in centimeters) to reach 25% extension.

AIR PERMEABILITY - High Flow Rate Method

Air permeability was measured by clamping a test sample in a gasketed flanged fixture which provided a circular area of approximately 39 square centimeters (about 7 centimeters diameter) for air flow measurement. The upstream side of the sample fixture was connected to a flow meter in line with a source of dry compressed air. The downstream side of the sample fixture was open to the atmosphere.

Testing was accomplished by applying a pressure of 12.7 millimeters of water to the upstream side of the sample and recording the flow rate of the air passing through the in-line flowmeter (a ball-float rotameter).

The sample was conditioned at 70°F and 65% relative humidity for at least 4 hours prior to testing.

Results are reported as cubic centimeters/minute/square centimeter of sample, at 12.7 millimeters water pressure.

AIR PERMEABILITY - Low Flow Rate Method

The resistance of samples having relatively low air permeability flow was measured by a Gurley densometer (ASTM D726-58) manufactured by W. & L.E. Gurley & Sons. The results are obtained in terms of Gurley Number which is the time in seconds for 100 cubic centimeters of air to pass through 6.45 square centimeters of a test sample at a pressure drop of 12.4 centimeters of water.

PORE SIZE MEASUREMENT

Pore size measurements are made by the Coulter Porometer (TM), manufactured by Coulter Electronics, Inc., Hialeah, FL.

The Coulter Porometer (TM) is an instrument that provides

automated measurement of pore size distributions in porous media using the liquid displacement method (described in ASTM Std. F316-86).

EXAMPLES

Example 1

This example demonstrates a three-layer embodiment of the stretchable water-vapor-permeable composite material and employs the following materials: two layers of a circular knitted fabric piled on one side, and a porous polymeric film.

The knitted napped fabric was made from a polyester yarn, had lower tensile modulus in the transverse direction than the machine direction and weighed 122 g/m^2. The knitted napped fabrics, Styles #7868 and #7869, were obtained from Malden Mills, Lawrence, MA 01841. Properties are shown in Table 1.

The porous polymeric film was a porous expanded polytetrafluoroethylene film as described in USP 3,953,566 (Gore), manufactured by W.L.Gore & Associates, Inc. of Newark, DE. The film was prepared from polytetrafluoroethylene fine powder using paste extrusion and calendering techniques and was expanded in both machine direction and transverse direction. The porous expanded polytetrafluoroethylene film had lower tensile modulus in the transverse direction than the machine direction, weight of about 4 grams/m^2, pore volume of about 82%, and thickness of about 12 micrometers. Additional properties are shown in Table 1.

The 3-layer composite material was prepared by a lamination process. The sequence of the lamination process was (1) application of adhesive by a gravure roll to one side of the porous expanded polytetrafluoroethylene film, (2) combining a layer of the knitted napped fabric to the adhesive side of the film by nipping between two rolls, (3) application of adhesive by a gravure roll to the film side of the resulting 2-layer composite, and (4) combining a second layer of knitted napped fabric to the film side of the composite by nipping between two rolls.

The lamination equipment was a multi-roll stack configuration

laminator which had a heated metal gravure printing roll. A feed reservoir on the heated gravure printing roll contained hot melt polyurethane adhesive of the type described in USP 4,532,316 (Henn) which was printed in a discontinuous pattern on the porous expanded polytetrafluoroethylene film as it passed through the nip of the gravure roll and a metal press roll. The adhesive printed film was then adhered to the non-napped surface of the circular knitted fabric by passage through the nip of the metal press roll and a silicone rubber surfaced roll, thus forming a 2-layer composite material.

The 2-layer composite material was then fed to a second multi-roll stack configuration laminator. As described above, the adhesive was printed in a discontinuous pattern on the porous expanded polytetrafluoroethylene film of the 2-layer composite material which was then adhered to the non-napped surface of the second layer of circular knitted fabric to form a 3-layer stretchable water-vapor-permeable composite material in which the axes of lower tensile modulus of the materials of the layers are in parallel alignment.

The pattern of adhesive application and the amount of adhesive applied can also influence the softness, drape and feel of the composite material as well as the mechanical properties of the composite material such as bond strength, stretch and stretch-recovery. It is recognized in the art that, for lamination of different knitted fabrics than used in the example above, some experimentation may be needed to determine the optimum adhesive laydown pattern and amount to obtain the desired properties in the composite material.

Table 1

Property	Fabric 1 #7868	Fabric 2 #7869	Both Fabrics	ePTFE Film	3-Layer Laminate
WVTR	12950	13670	7815	>80000	7675
Air Permeability*	>3000	>3000	NM	39.6	∠30.5
F/D Ratio (trans.)	2.63	1.37	NM	1.08	6.84

* ($cm^3/min/cm^2$ at 12.7 mm water pressure)

NM - (Not Measured)

The 3-layer stretchable water-vapor-permeable composite material of Example 1 had excellent softness and drape characteristics. It required a low force to stretch at least 25% and exhibited stretch-recovery greater than 90%. It also had excellent windproofness, as indicated by the low air permeability values in Table 1, and excellent WVTR properties.

Comparative Example 1

A three-layer composite material was prepared for comparative purposes. Materials and processing were as described in Example 1 above except that a different porous polymeric film was used.

The porous polymeric film was a porous expanded polytetrafluoroethylene film as described in USP 3,953,566 (Gore), manufactured by W.L.Gore & Associates, Inc. The membrane was prepared from polytetrafluoroethylene fine powder using paste extrusion and calendering techniques and was expanded in the transverse direction. The porous expanded polytetrafluoroethylene film had higher tensile modulus in the transverse direction, and an F/D ratio, at 25% extension in the transverse direction, greater than 3.5. The porous expanded polytetrafluoroethylene film had a weight of about 17 grams/m^2, a pore volume of about 82%, and a thickness of about 43 micrometers. Properties are shown in Table 2.

In contrast to the composite materials of the invention, the layers of the comparative example were oriented such that the axis of lowest tensile modulus of the porous expanded polytetrafluoroethylene film was perpendicular to the axis of lowest tensile modulus of the fabric.

Table 2

Property	Fabric 1 #7868	Fabric 2 #7869	Both Fabrics	ePTFE Film	3-Layer Laminate
WVTR	12950	13670	7815	>80000	7675
Air Permeability *	>3000	>3000	NM	<30.5	<30.5
F/D Ratio (trans.)	3.64	1.37	NM	11.6	16.2

* ($cm^3/min/cm^2$ at 12.7 mm water pressure)

NM - Not Measured

The material of the comparative example had relatively poor softness and drape characteristics compared to the material of Example 1, and the force required to stretch the material 25% was excessive.

Example 2

This example demonstrates a two-layer embodiment of the stretchable water-vapor-permeable composite material and employs the following materials: a layer of circular knitted brushed cotton fabric, and a porous polymeric film coated with a continuous substantially air-impermeable layer of hydrophilic polyurethane polymer.

The circular knitted brushed cotton fabric was Style 6900 fabric obtained from Milliken & Co.. The fabric had lower tensile modulus in the transverse direction than in the machine direction and a weight of approximately 170 g/m^2. Additional properties are shown in Table 3.

The porous polymeric film was a porous expanded polytetrafluoroethylene film as described in USP 3,953,566 (Gore), manufactured by W.L.Gore & Associates, Inc.. The film was prepared from polytetrafluoroethylene fine powder using paste extrusion and calendering techniques and was expanded in both machine direction and transverse direction. The porous expanded polytetrafluoroethylene film had lower tensile modulus in the transverse direction than in the machine direction, a weight of about 2-3 grams/m^2, a pore volume of about 82%, and a thickness of

about 8 micrometers. Additional properties are shown in Table 3.

The 2-layer composite material was prepared by a lamination process in which the porous expanded polytetrafluoroethylene film was (1) coated with a continuous layer of hydrophilic polyurethane polymer and then (2) combined with the knitted brushed cotton fabric by nipping between two rolls; the continuous layer of hydrophilic polyurethane served as adhesive to bond the layers together. The hydrophilic polyurethane polymer was a reactive hot melt, hydrophilic polyurethane prepared according to the teachings of USP 4,532,316 (Henn).

The coating/lamination equipment used was a roll coater in a 4-roll stack configuration. The stack included a heated metal gravure roll having a mounted feed reservoir containing the hot melt polyurethane polymer. The gravure roll transferred the polyurethane polymer to a fluoroelastomer surfaced roll. The fluoroelastomer surfaced roll applied a continuous layer of the polyurethane polymer to the surface of the porous expanded polytetrafluoroethylene film as the film was nipped between the fluoroelastomer surfaced roll and a heated metal press roll. The fabric was combined with the porous expanded polytetrafluoroethylene film on the opposite side of the metal press roll as they passed through the nip between the metal press roll and a silicone rubber surfaced roll.

Table 3

Property	Fabric #6900	ePTFE Film	Coated Film	2-Layer Laminate
WVTR	NM	>80000	NM	18909
Air Permeability*	>3000	76	<0.3	<0.3
F/D Ratio (trans.)	1.56	0.20	0.68	3.03

* ($cm^3/min/cm^2$ at 12.7 mm water pressure)

NM - Not Measured

The 2-layer stretchable water-vapor-permeable composite material of Example 2 had excellent softness and drape characteristics. It required very low force to stretch at least 25% and exhibited stretch-recovery greater than 90%. It also had

excellent windproofness and excellent WVTR properties.

The low flow rate test method was used to measure air permeability of the material of Example 2 and, for consistency in reporting, results were converted to $cm^3/min/cm^2$ at 12.7 mm water pressure as shown in Table 3.

Due to high uptake of moisture by the composite material of Example 2, the test time for WVTR measurements shown in Table 3 was extended from 15 minutes to 30 minutes to permit steady state conditions to be reached.

The composite material of Example 2 was fashioned into undergarments. The undergarments were worn with the brushed cotton surface next the skin and the coated polytetrafluoroethylene film surface outward and were found to be unexpectedly comfortable by the wearers. The mechanically related comfort properties such as skin-feel, softness, ease of stretching and amount of stretch-recovery were found to be excellent, however, the greatest surprise was due to the exceptional temperature/humidity control provided by the undergarments. The mechanism for this is not fully understood, but it is felt that the high loft and high moisture wicking characteristics of the brushed cotton fabric in conjunction with the high water vapor transmission rate and lack of air movement through the composite material combine to quickly develop, and then maintain, a comfortable microclimate next the skin.

CLAIMS:

1. A stretchable water vapor permeable composite material comprising a layer of porous film adhesively laminated to a layer of fabric; said porous film and said fabric having lower tensile modulus in the transverse direction than in the machine direction and having their axes of lower tensile modulus in parallel alignment, and each having, at 25% extension in the transverse direction, a force to displacement (F/D) ratio per inch width less than 3.5; and said composite material having, at 25% extension in the transverse direction, an F/D ratio per 2.54 cm width less than 9.0.

2. The stretchable water vapor permeable composite material of claim 1 wherein the porous film is porous expanded polytetrafluoroethylene

3. The stretchable water vapor permeable composite material of claim 1 wherein the porous film is coated with a continuous substantially air-impermeable layer of hydrophilic polymer, the coated porous film having, at 25% extension in the transverse direction, an F/D ratio less than 3.5.

4. The stretchable water vapor permeable composite material of claim 2 wherein the porous film is coated with a continuous substantially air-impermeable layer of hydrophilic polymer, the coated porous film having, at 25% extension in the transverse direction, an F/D ratio less than 3.5.

5. The stretchable water vapor permeable composite material of claim 3 or claim 4 wherein the hydrophilic polymer is a hydrophilic polyurethane polymer.

6. A stretchable water vapor permeable composite material comprising a layer of porous film to each side of which is adhesively laminated a layer of fabric; said porous film and said fabric having lower tensile modulus in the transverse direction than in the machine direction and having their axes of lower tensile modulus in parallel alignment, and each having, at 25% extension in the transverse direction, a force to displacement (F/D) ratio per 2.54 cm width less than 3.5; and said composite material having, at 25% extension in the transverse direction, an F/D ratio per 2.54 cm width less than 9.0 .

7. The stretchable water vapor permeable composite material of claim 6 wherein the porous film is porous expanded polytetrafluoroethylene.

8. The stretchable water vapor permeable composite material of claim 6 wherein the porous film is coated with a continuous substantially air-impermeable layer of hydrophilic polymer, the coated porous film having, at 25% extension in the transverse direction, an F/D ratio less than 3.5.

9. The stretchable water vapor permeable composite material of claim 7 wherein the porous film is coated with a continuous substantially air-impermeable layer of hydrophilic polymer, the coated porous film having, at 25% extension in the transverse direction, an F/D ratio less than 3.5.

10. The stretchable water vapor permeable composite material of claim 8 or claim 9 wherein the hydrophilic polymer is a hydrophilic polyurethane polymer.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 92/03808

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B32B27/12; A41D31/02

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B32B ; A41D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	GB,A,2 155 853 (NITTO ELEC. IND. CO.) 2 October 1985 see page 4, line 1 - line 4 see page 4, line 55 - page 5, line 10; figures 1,2	1,2,6,7
Y		3-5,8-10

Y	US,A,4 194 041 (GORE ET AL.) 18 March 1980 cited in the application see column 1, line 25 - line 38 see column 4, line 11 - line 30 see column 5, line 7 - line 9 see column 5, line 45 - line 52 see column 9, line 57 - line 62	3-5,8-10

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° Special categories of cited documents : [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
04 DECEMBER 1992	22. 12. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	IBARROLA TORRES O.

Form PCT/ISA/210 (second sheet) (January 1985)

International Application No PCT/US 92/03808

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

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A	WO,A,9 000 969 (GORE & ASSOCIATES, INC.) 8 February 1990 see page 10, line 10 - page 11, line 22; claims 1,11	5,10
A	GB,A,2 074 093 (GORE & ASSOCIATES, INC.) 28 October 1981 see page 3, line 2 - line 83	1-4,6-9

Form PCT/ISA/210 (extra sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 9203808 SA 60697

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 04/12/92
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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